FC-700

SERVICE MANUAL

BioNet CO., LTD.

Terms of Warranty

- This product is manufactured and passed through strict quality control and inspection.

- Compensation standard concerning repair, replacement, refund of the product complies with “Consumer’s protection law” noticed by Economic Planning Dept.

- FC-700 is warranted by Bionet Co.,Ltd to be free from defects in material and workmanship for two years from date of purchase.

- Warranty repair or replacement will be made by Bionet Service Center at no charge during warranty period if properly used under normal condition in accordance with the instructions for use.

- In the event of a malfunction or failure during warranty period, customer should inform Bionet Co.,Ltd of the model name, serial number, date of purchase and explanation of failure about the defective equipment.

Definition of Warning, Caution, Note

- For a special emphasis on agreement, terms are defined as listed below in operation manual. Users should operate the equipment according to all the Warning and Caution instructions.
- Manufacturer or Sales agency takes no responsibility for any kind of damage or breakdown that is caused by misuse and failure to maintain the equipment..

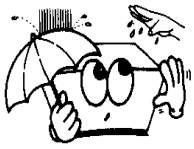
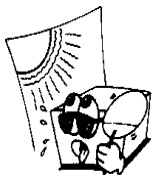
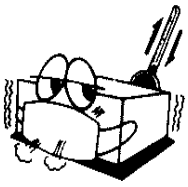
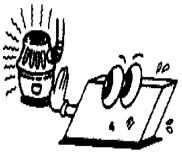
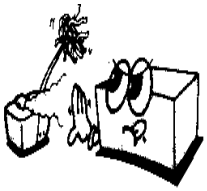
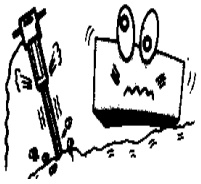
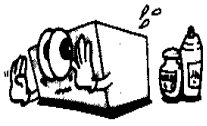
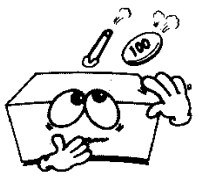
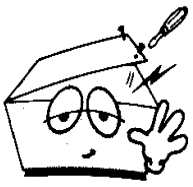
Warning
Be informed that it may cause serious injury or death to the patient, property damage, material losses against the “Warning” sign.

Caution
Be informed that it may cause no harm in life but lead to injury against the “Caution” sign.

Note
Be informed that “Note” sign is used for notifying some important contents relating to installations, use, maintenance for users, but not dangerous.

General Precaution on Environment

- Do not keep or operate the equipment in the environment listed below.

	Avoid placing in an area exposed to moist. Do not touch the equipment with wet hand .		Avoid exposure to direct sunlight
	Avoid placing in an area where there is a high variation of temperature. Operating temperature ranges from 10°C to 40°C. Operating humidity ranges from 30% to 85%.		Avoid in the vicinity of Electric heater
	Avoid placing in an area where there is an excessive humidity rise or ventilation problem.		Avoid placing in an area where there is an excessive shock or vibration.
	Avoid placing in an area where chemicals are stored or where there is in danger of gas leakage.		Avoid dust and especially metal material into the equipment
	Do not disjoint or disassemble the equipment. Bionet Co.Ltd takes no responsibility of it		Power off when the equipment is not fully installed. Otherwise, equipment could be damaged.

General Precaution on Electric Safety

Check the items listed below before operating the equipment.

- Be sure that power supply line is appropriate to use.
  (Power Adaptor Input : 100 - 240V AC, Power Adaptor Output : 18V, 2.5A).
- Be sure that the entire connection cable of the system is properly and firmly fixed.

Note : The equipment should not be placed in the vicinity of electric generator, X-ray, broadcasting apparatus to eliminate the electric noise during operation. Otherwise, it may cause incorrect result.
Self-power line is important for FC-700. To use same power source with other electric instruments may cause incorrect result.

Note : FC-700 is classified as listed below ;

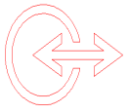
- This equipment conforms to Class I, Type-BF.
- Do not use the equipment in the vicinity of flammable anesthetics and solvents.
- The equipment conforms to Class I according to IEC/EN 60601-1 (Safety of Electric Medical Equipment)
- This equipment conforms to Level B according to IEC/EN 60601-1-2 (Electromagnetic Compatibility Requirements)

Note : Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC standards (e.g. IEC 950 for data processing equipment and IEC 601-1 for medical equipment). Furthermore all configuration shall comply with the system standard EN 60601-1-1:1993.
If in doubt, consult the technical service department or your local representative.

Safety Symbols

- The International Electrotechnical Commission (IEC) has established a set of symbols for medical electronic equipment which classify a connection or warn of any potential hazards. The classifications and symbols are shown below.

Save these instructions.

Symbols	contents
	Isolated patient connection. (IEC 601-1-Type BF)
	Device part switched off.
	Device part switched on.
	Conductor provides a connection between equipment and the potential equalization busbar of the electrical installation
	External Signal IN/OUT Port

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1. Product Overview

1) Product Description

FC-700 is the fetal monitor that measures the fetal heart rate and uterine contraction. FC-700 irradiates ultrasound wave to the abdomen of a pregnant woman, and detects the Doppler frequency signal reflected from the heart of the fetus. FC-700 analyzes this signal and displays the heart rate by LED. Also, FC-700 provides the sound from the heart of fetus.

FC-700 measures the uterine contraction of a pregnant woman by pressure sensors and displays the numerical values.

And FC-700 records the heart rate of the fetus, fetal movement and the values of uterine contraction.

2) Product Features

- FC-700 records the heart rate of the fetus, fetal movement and the uterine contraction of a pregnant woman, and basic information of the equipment with wide A4 Size paper.
- FC-700 can use general fax paper as well as thermal paper for fetal monitor.
- FC-700 has automatic NST function which records FHR, UC and fetal movement only for the established time.

3) Product Configuration

FC-700 system consists of the following. Unpack the package and check the followings are included. Also, be sure to check any damage to the main body and accessories.

① FC-700 main body

② Ultrasound Doppler Probe (1 EA)

③ UC Probe (1EA)

④ Event Mark Jack (1EA)

⑤ Print Paper (1EA)

⑥ Power Adaptor (1EA)

⑦ Power Cord (1EA)

⑧ Ultrasound Gel (1EA)

⑨ Probe Belt (2EA)

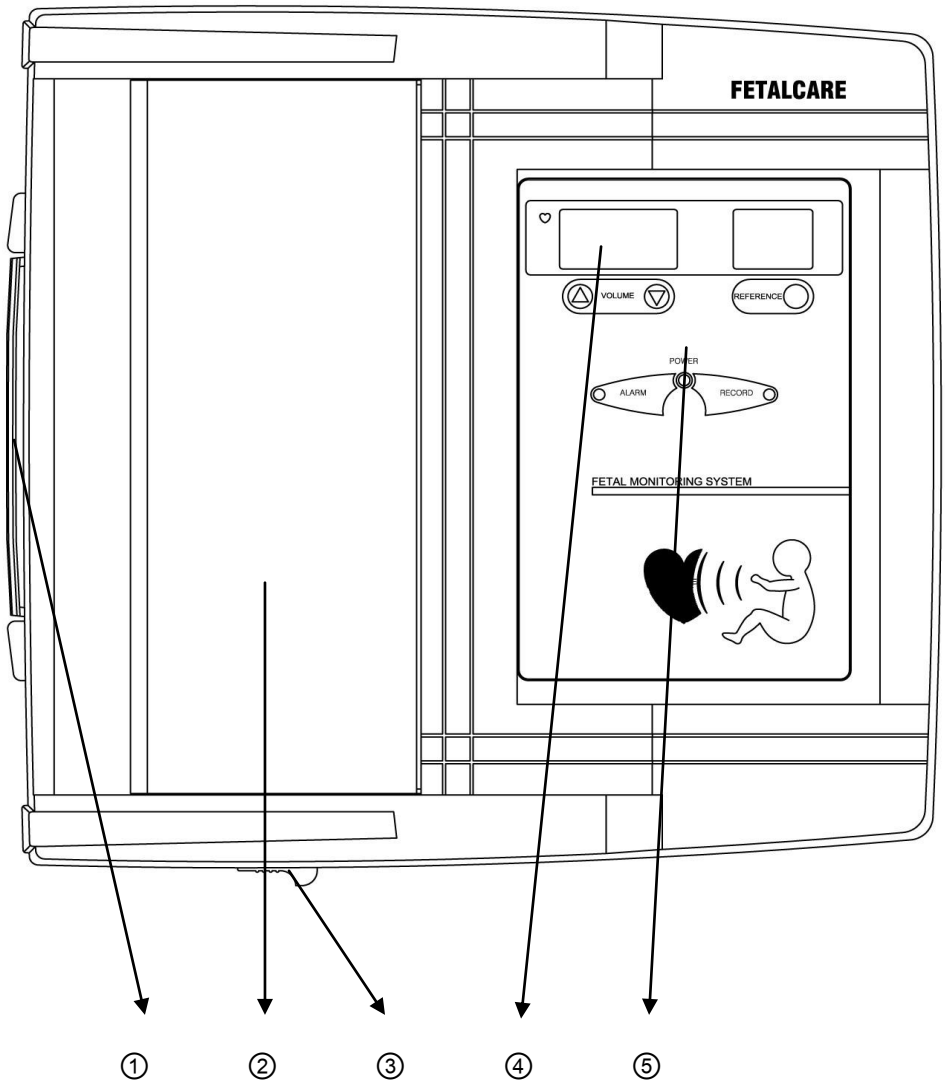
⑩ Operation Manual (1EA)

⑪ Stand (1EA)

⑫ Basket (1EA)

4) Main Body configuration

▣ **Top view**



① Hand Grip

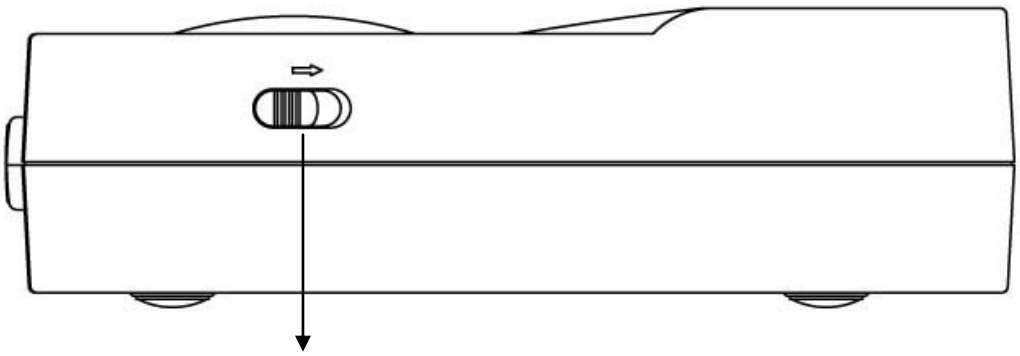
② Printer door

③ Printer door release button

④ Display LED

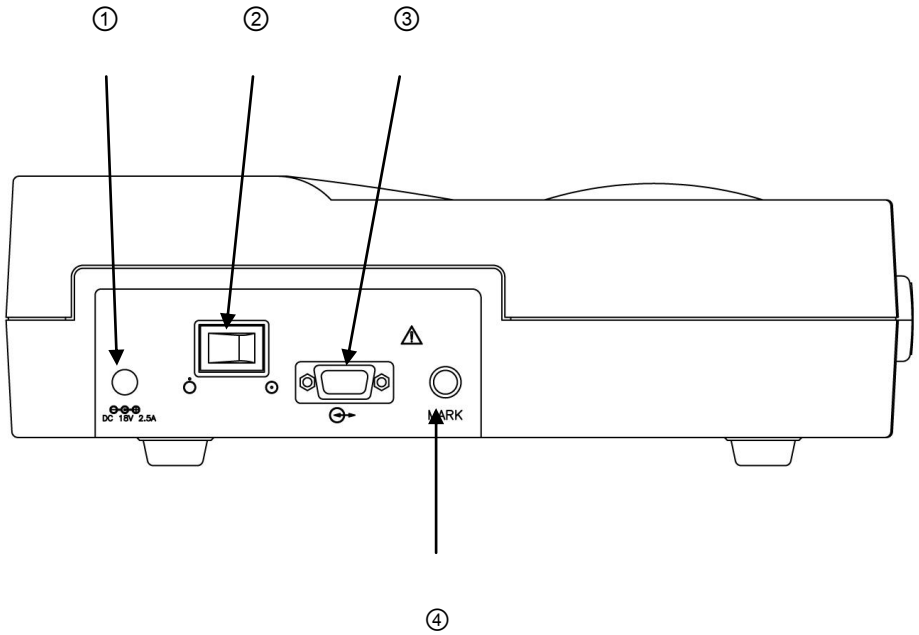
⑤ Control panel

▣ Front view



① Printer door release button

▣ Rear view



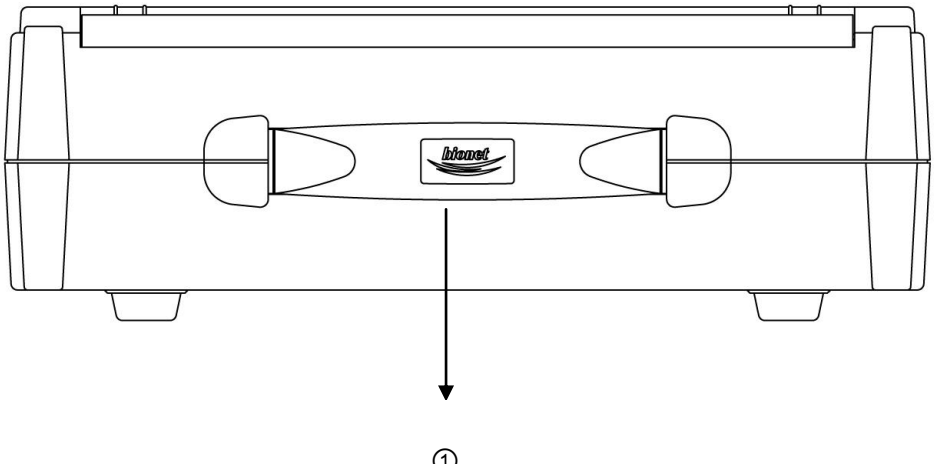
① Power adaptor connection port

② Power on/off switch

③ RS-232C serial port

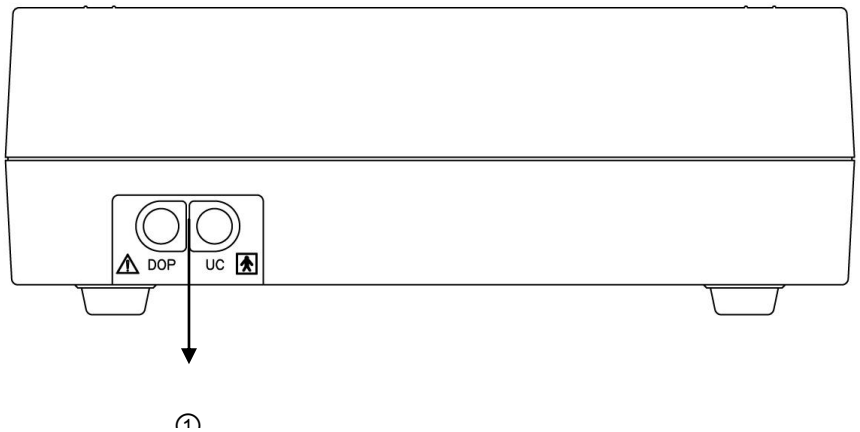
④ Mark Jack connection port

▣ Left side view



① Hand Grip

Right side view

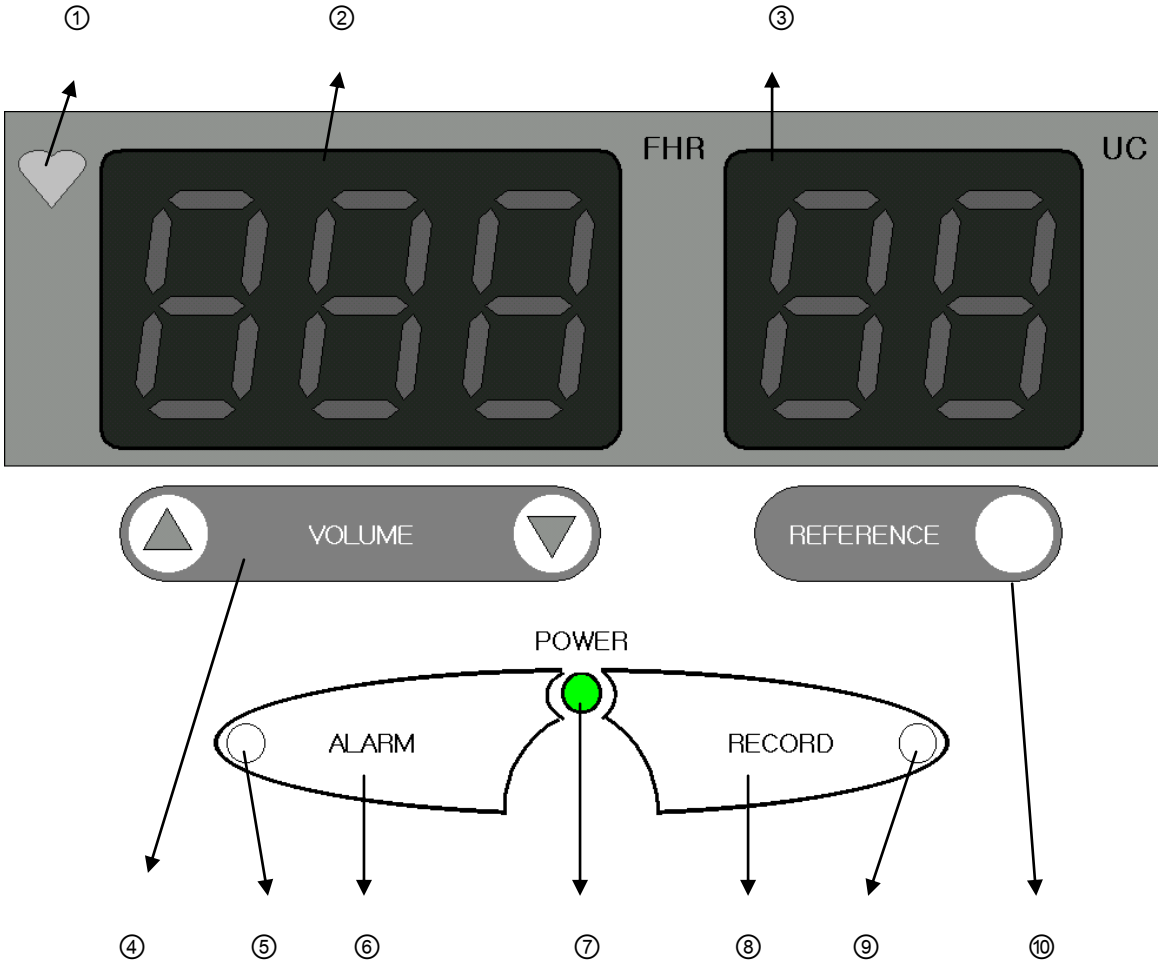


① Doppler, UC Probe connection port

Warning

To avoid an expected electric shock, do not open the equipment cover or disassemble the equipment. Refer servicing to qualified personnel of Bionet Co., Ltd.

▣ Control Panel



① Heart rhythm symbol (Green : stable, Red : unstable).
② Heart rate of the fetus (bpm).
③ UC measurement value.
④ Volume up/down key. During the use of the Menu for setup, this key is used to change the setting value.
⑤ LED of the alarm on/off
⑥ Alarm on/off key. During the use of the Menu for setup, this key is used to set the function of the time and date.
⑦ LED of the power on/off
⑧ Print on/off Key. When setup mode, store the setting value. When out of

print, paper feeding function.

⑨ LED of the print on/off

⑩ Key setting UC value as reference value(10). When setup mode, printing related functions setup.

4) Product Installation

▣ Attention in Installation

Pay attention to the following in installing FC-700:

① Use it at the temperature between 10 and 40 degrees centigrade and at the humidity between 30 and 85 percent.

② Check plug-in and treat the Probe Cable carefully.

③ Don't put several plugs in an outlet.

④ Install the main body at the flat place.

⑤ Avoid using a plug making a noise in plug-in.

⑥ All the setup will be recorded at the interior memory even when it is switched off and then on.

⑦ Be careful, as it is easy to break by the shock.

⑧ Install it away from dust or inflammable things in consideration of the temperature and humidity.

▣ Power Supply

Use free voltage of AC between 100 and 250V. If a plug is put in an outlet, the "POWER" LED at operation panel will be turned on green. Within the equipment is a battery to change the date and time even when it is switched off. Use a Type CR2032 3V Lithium Battery.

☞ **Note!**
Don't throw away batteries carelessly to protect environment, but ask the hospital for the designated places to dump batteries according to proper procedure.

▣ Plug-in

Put the plug in an outlet of 110V or 220V and connect one side of power cable to the power adaptor. If you put the plug of power adaptor in the terminal of power adaptor of the main body of FC-700 and then switch it on, the equipment will work.

If the power supply is normal, LED at the operation panel indicating Power On/Off will be turned on green.

▣ Connection of the Probe Cable

Connect the Probe Cable to the Probe Cable terminal at the right side of the main body.

Connect the Doppler Probe to the “DOP” terminal and the UC Probe to the “UC” terminal.

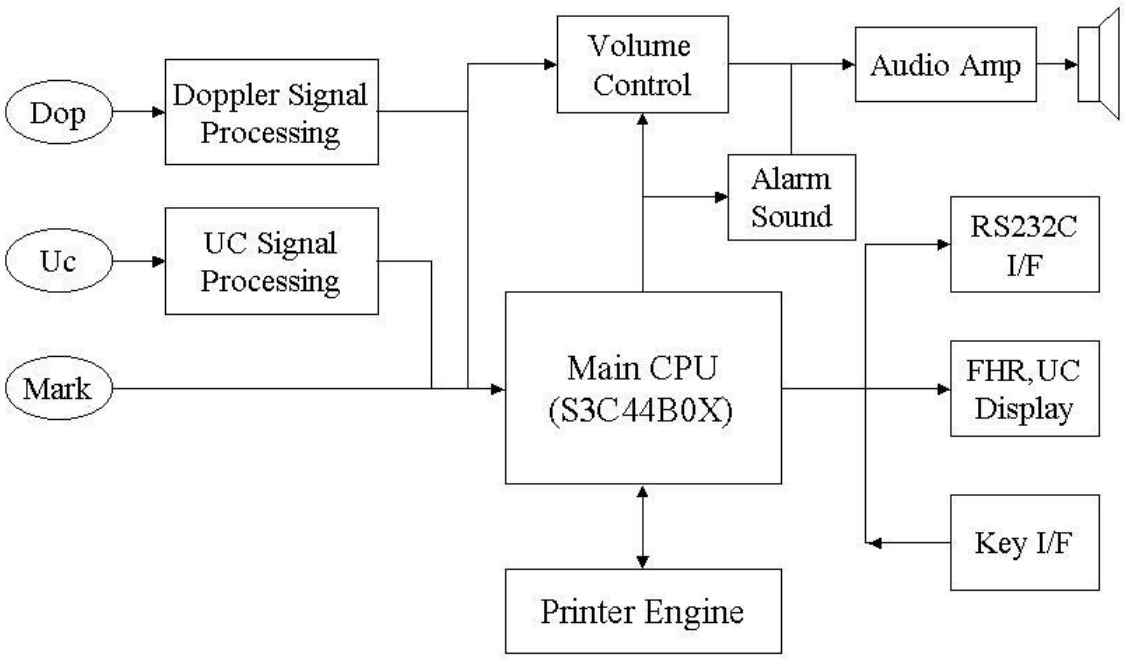
Connect Mark Jack to the “MARK” terminal at the backside of the main body.

▣ Setting of Recording Paper

If you release the button to open the printer cover at the front of FC-700 to the right, it will open. Put recording paper with the recording part on the upper side adjusting the paper roll parallel to the print direction and then close the cover.

2. Functional Block Analysis

1) Overall Block Diagram



Overall Block Diagram is mainly divided into an analogue part and digital part.

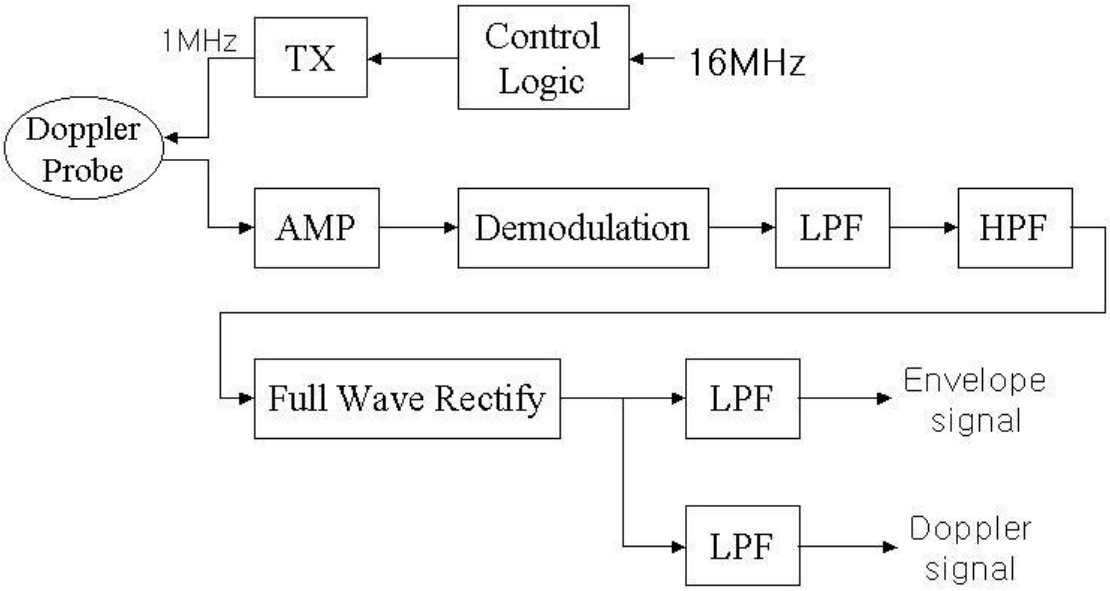
The analogue part consists of the Doppler & UC probe analogue part where receives

bio-signals (Doppler sound & UC) and an analogue-to-digital converter which charges the analogue signals into the digital signals. Also it processes the out of the Doppler & alarm sound.

The digital part consists of those parts below.

1. Analogue to digital converting : the signal of FHR & UC, Fetal movement
2. Display : the values of FHR & UC
3. Alarm sound generation
4. Volume control
5. Key scan
6. Print date generation
7. Interface of PC (RS232)

2) Doppler Signal Processing Block

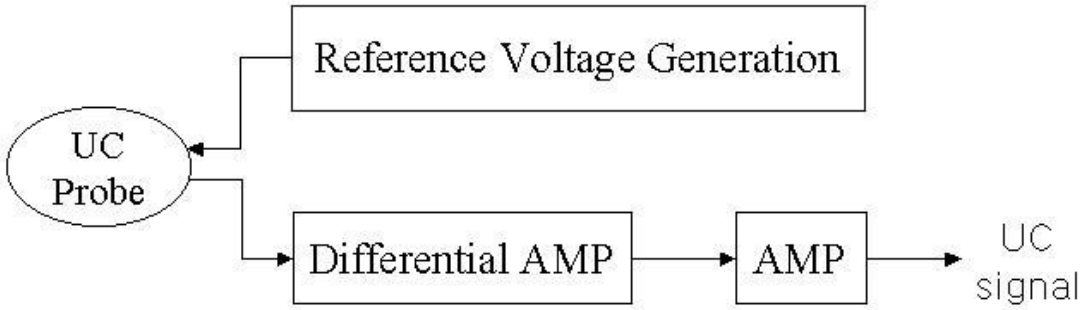


Doppler Signal Processing Block consists of those parts below.

1. Control logic : generate the Tx wave using the 16MHz clock
2. Tx : Amplify the signal where receives control logic and then transport the signal to Doppler probe.

3. AMP : Amplify the signal where receives Doppler probe
4. Demodulation : Demodulate the signal from the AMP
5. LPF & HPF : Filtering the signal
6. Full wave rectify

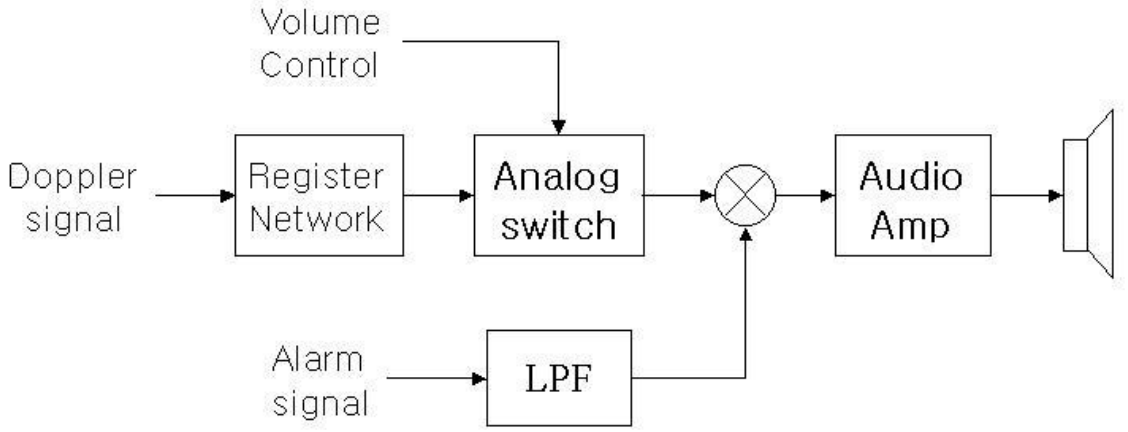
3) UC Signal Processing Block



UC Signal Processing Block consists of those parts below.

1. Amplify UC signal which is measured by using the Strain gage.
2. Convert the analogue signal to the digital signal.

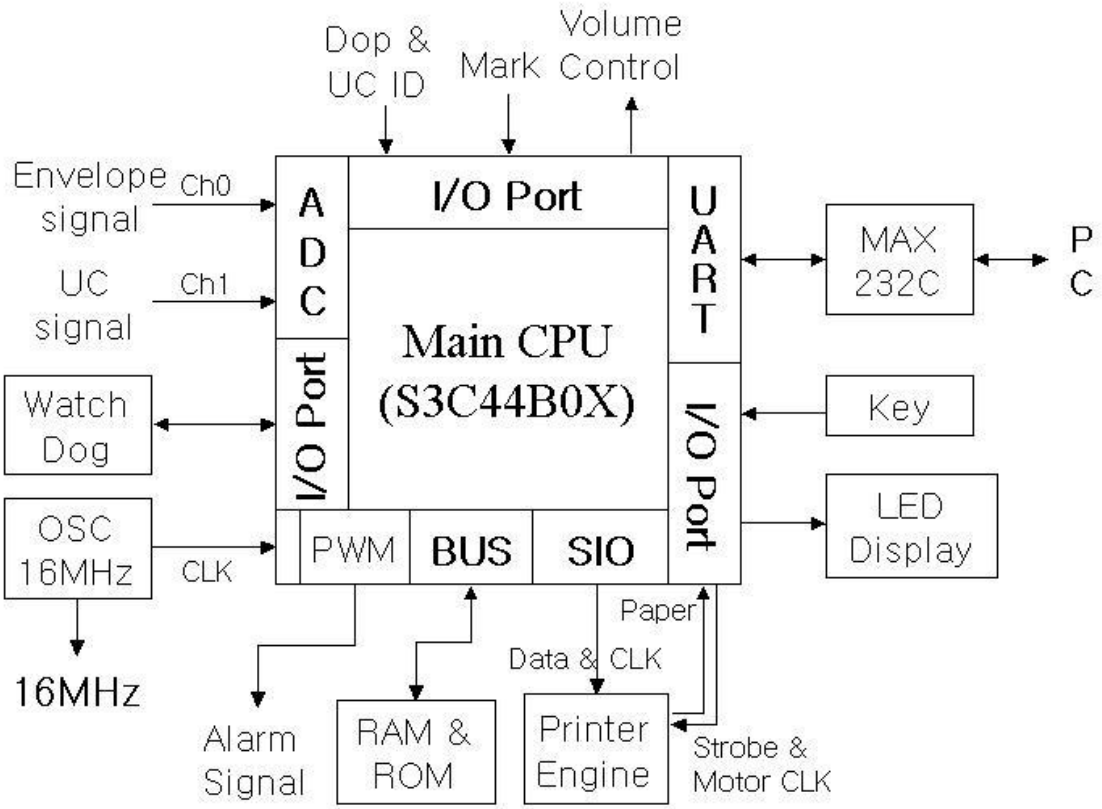
4) Sound Block



Sound Block consists of those parts below.

1. Control the volume level of the Doppler signal
2. After receiving the Doppler signal & Alarm signal, make the output of sound by using the Audio Amp.

5) Main CPU Block

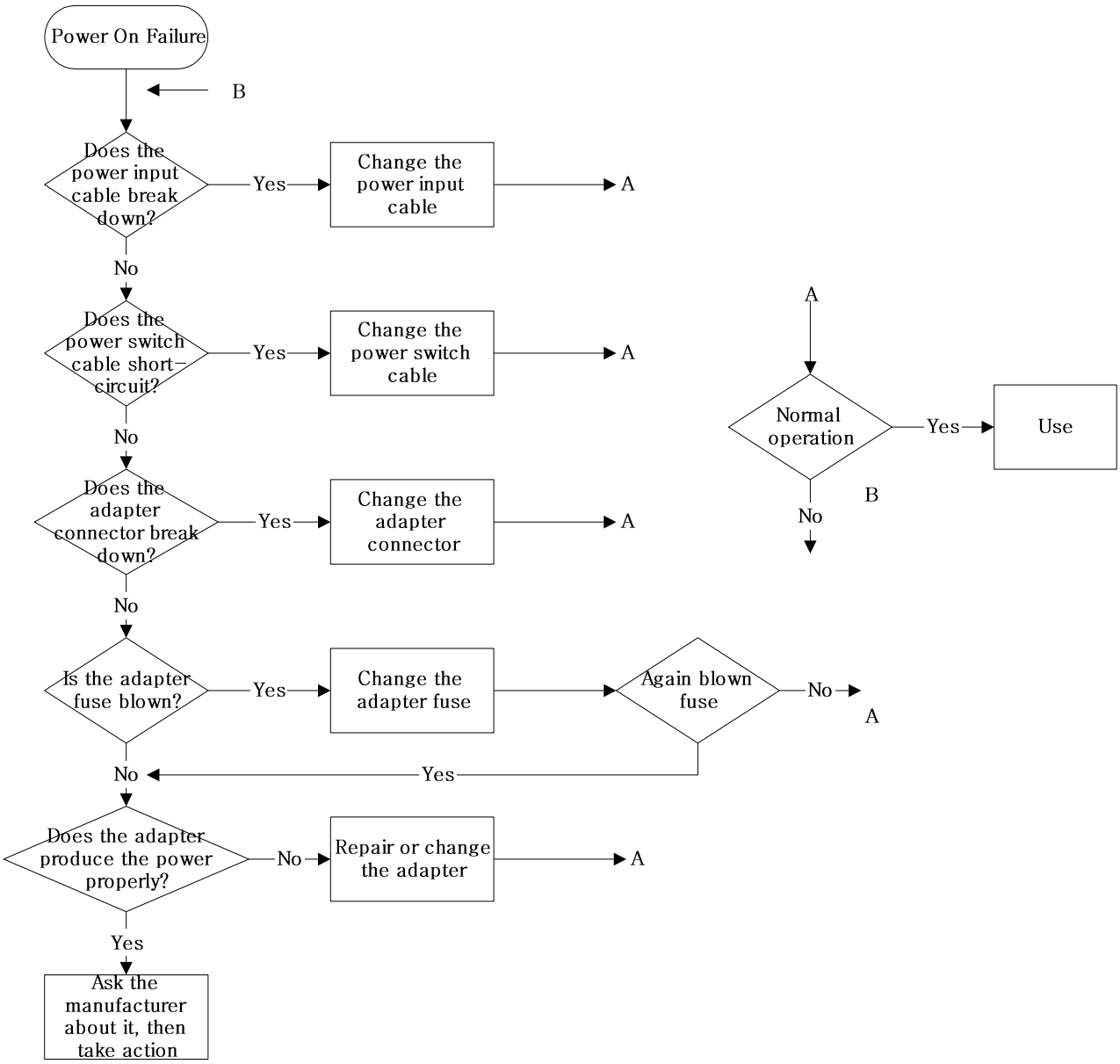


Main CPU Block consists of those parts below.

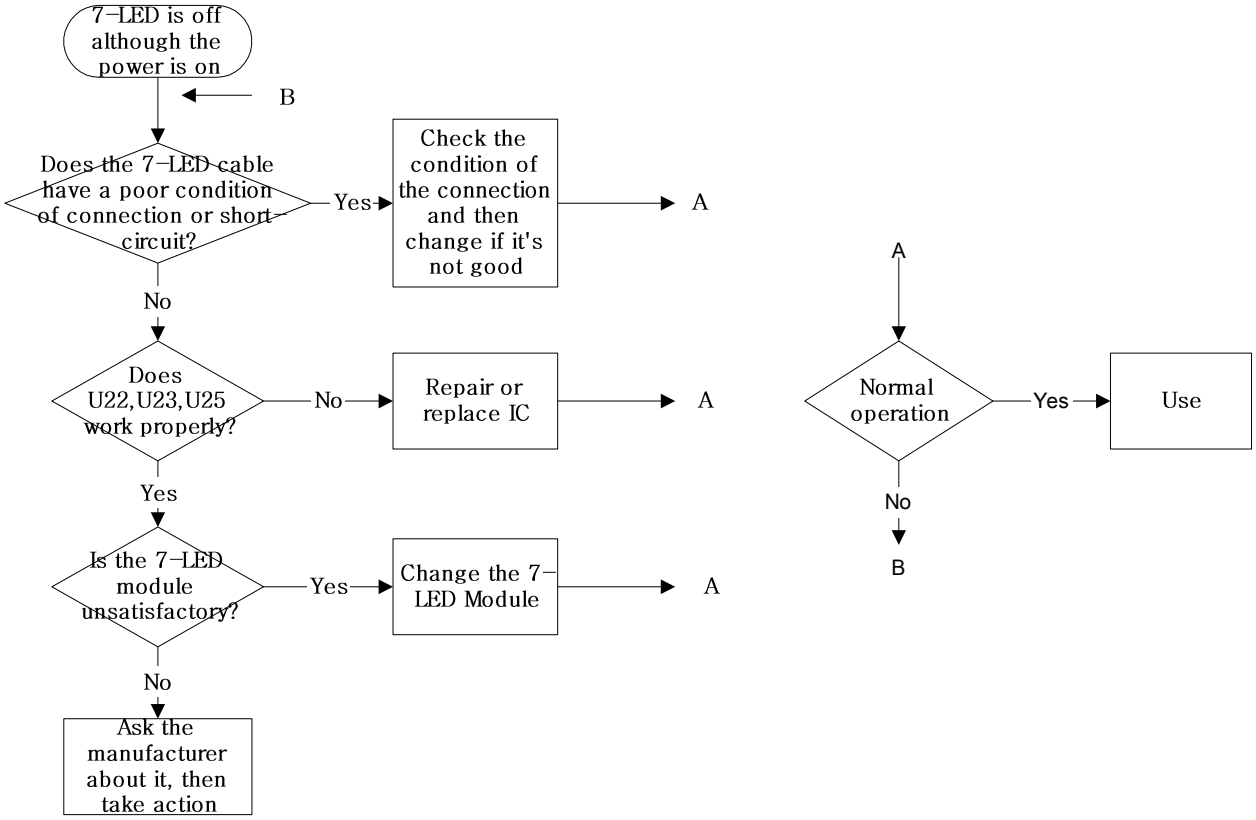
1. Calculate the FHR & UC values after processing the signal of the Doppler & UC input and then output the signal in the 7-LED display
2. Check the status of the connection between Doppler & UC and main body, and then send the message of the status
3. Transport the Mark signal to print and Central monitoring system
4. Control the sound volume.
5. Generate the control signal and date of the printer & motor by using the printer engine, and then check the paper empty
6. Apply and save the status of Print & Alarm, Time setup after receiving the key input.
7. Generate the check-signal of Watch Dog.

3. Troubleshooting

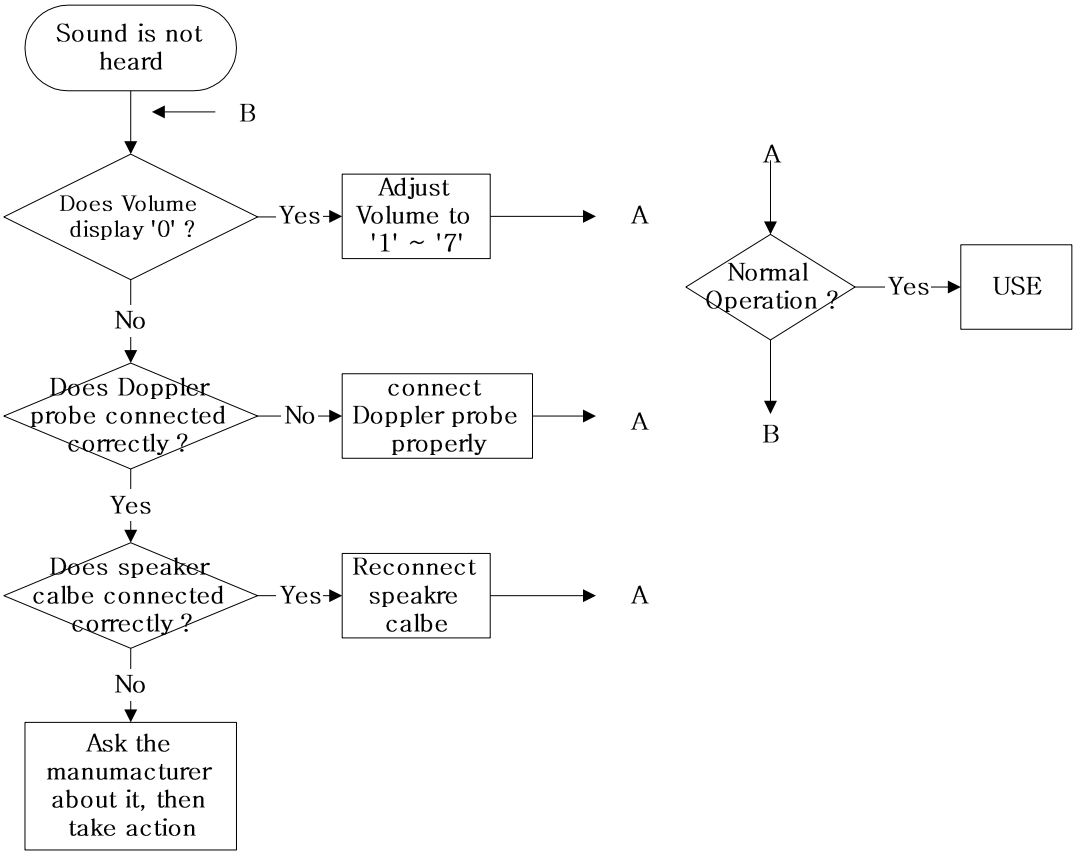
1) Power On Failure



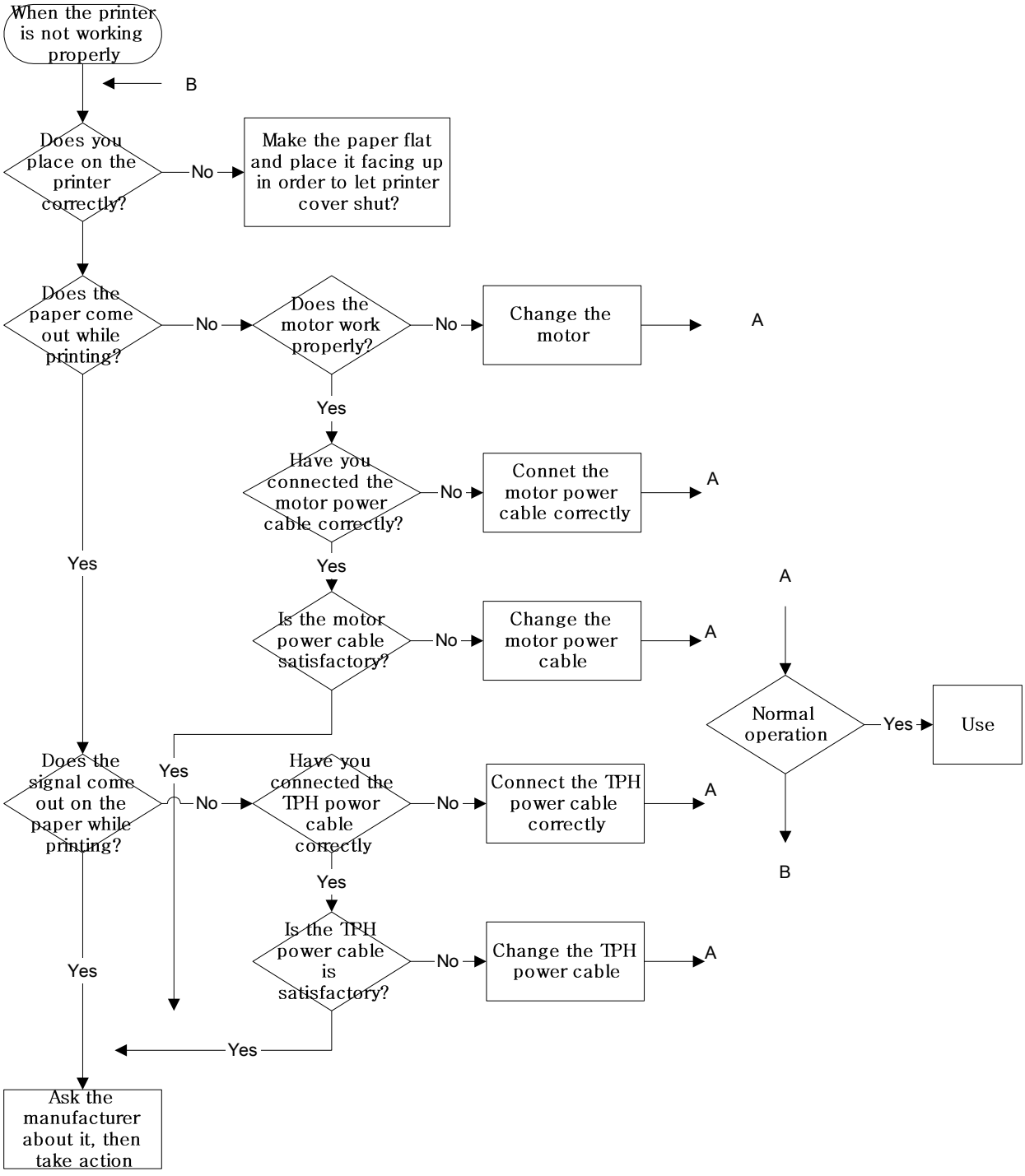
2) 7-LED is off although the power is on



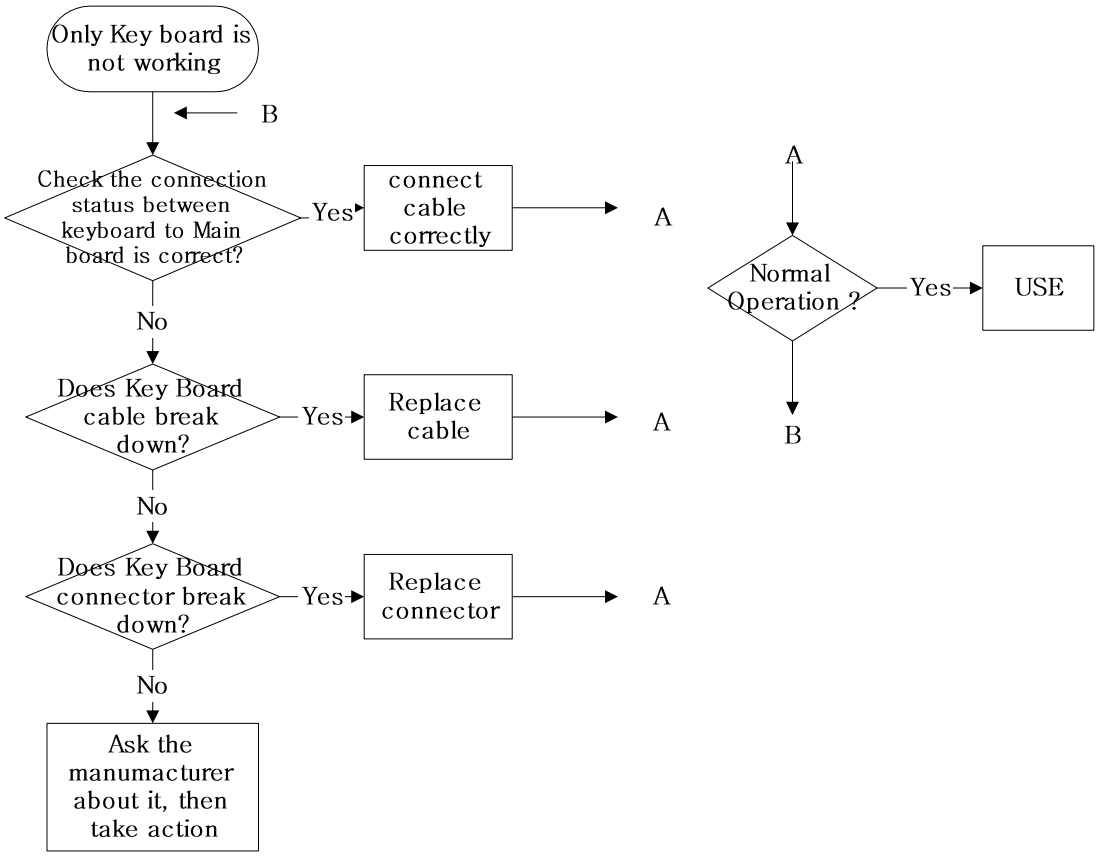
3) Sound is not heard



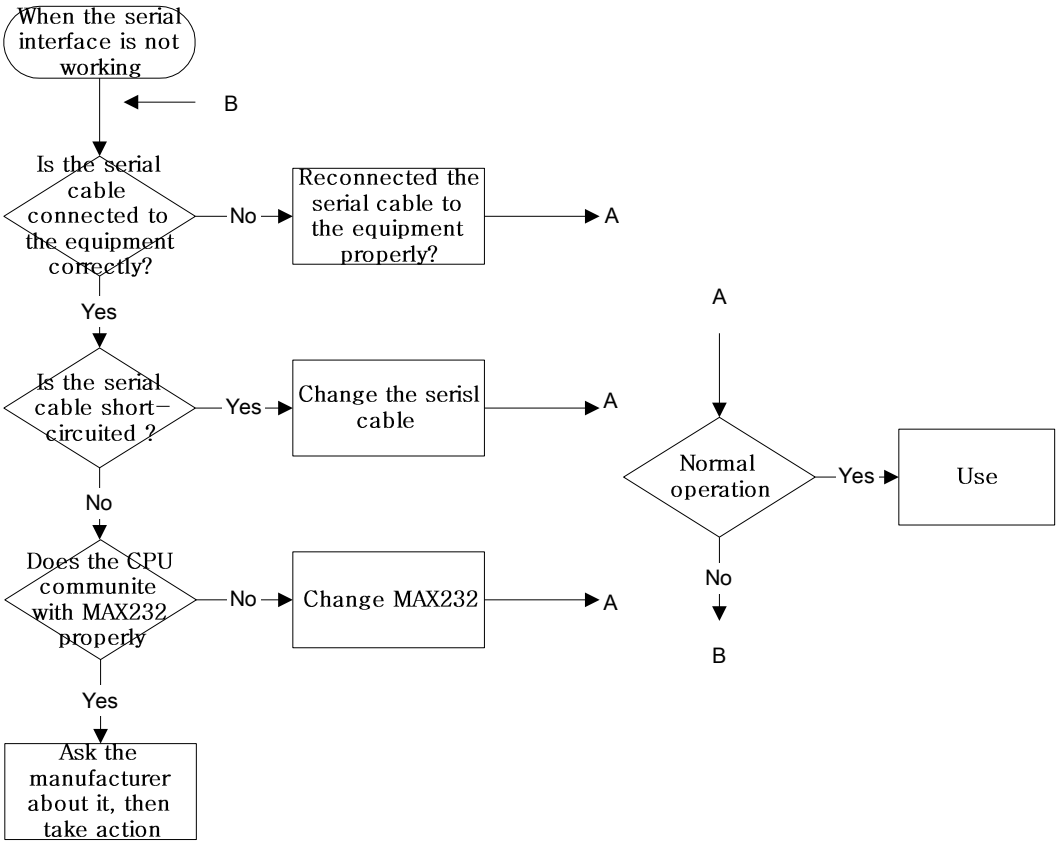
4) When the printer is not working properly



5) Key board is not working



6) When the serial interface is not working



4. Technical Specification

- **Environmental Specifications**

Temperature Range

Operating : 10 to 40℃

Storage : -10 to 60℃

Relative Humidity Range
Operating : 30 ~ 85%
Storage : 20 ~ 95%
Atmospheric Pressure Range
Operating : 70 ~ 106kPa
Storage : 70 ~ 106kPa

- **Power Specifications**

Power Adaptor Input : 100 - 250VAC, 50/60Hz, about 80VA
Power Adaptor Output : 16V, 2.8A
Power Fail Protection
Battery : CR 2032 3V Lithium battery

- **Performance Specifications**

FHR Measurement
Input signal : Ultrasound Pulsed Doppler
Ultrasound Frequency : 1.0 MHz
Ultrasound Power : <10mW/cm^2
FHR Detection Method: Auto Correlation
Measurement Range : 50 ~ 240 beats per minutes(BPM)
FHR Accuracy : ±1 bpm over normal FHR range

UC Measurement
Input Source : External Transducer with strain gauge
Frequency Response : DC ~ 0.5 Hz

Reference(Zero) Control : One touch switch

Measurement Range : 0 ~ 99 units

Fetal Movement Measurement

Detection Source : Ultrasound Pulsed Doppler

Recording Method:

① Spike-like waveform on UC channel denotes relative intensity and duration of Fetal Movement.

② Dot marks between FHR and UC channels when FM intensity exceeds selected threshold.

Recorder

Recorder Method : Thermal Array Type

Resolution: 8(vertical)/10(horizontal) dot/mm

Print Speed : 1, 2, 3 cm/min

Paper Feeding Function

Paper Grid : On/Off

Print Contrast : 1, 2

Auto Print Period : 0, 10, 20, 30, 40, 50, 60

Fetal movement: On/Off

Display

Five 7-Segment LED

2 Channels (FHR, UC)

Indicators

Heart Rhythm (Green : Stable, Red : Unstable)

Alarm On/Off State

Print On/Off State

AC Power (Green LED)

Sound

Doppler Sound with Volume Control (8 steps)

Alarms Sound :

Information Sound : Doppler Probe off, Paper off, Watch Dog, Set-up Data

Storage

NST End.

Set-up

Alarm Upper/Lower Limit Value

Alarm check delay time

Print Speed

Paper Grid

Print Contrast

Auto Print Period(NST time)

Time / Date

Fetal Movement On/OFF

Fetal Movement Detection Threshold

Function

Event Mark Function

External Link

RS232C : Program Down Load, Central (Option)

5. Service Part List

Item	Quantity	Reference	Part
1	1	BT1	3V 2032 Lithium Ion Battery
2	3	C1, C141, C142	330pF
3	86	C2,C4,C5,C6,C7,C8,C9,C12, C16,C18,C19,C20,C21,C24, C27,C29,C32,C33,C34,C35, C36,C37,C38,C39,C40,C42, C43,C44,C45,C47,C48,C50, C52,C54,C55,C56,C57,C58, C59,C62,C63,C64,C65,C68, C70,C71,C72,C75,C76,C81, C83,C84,C86,C87,C88,C91, C97,C99,C109,C110,C112, C113,C114,C115,C116,C117, C118,C119,C120,C121,C122, C123,C124,C125,C126,C127, C129,C133,C134,C135,C140, C144,C146,C149,C150,C151	100nF
4	7	C3,C41,C66,C67,C78,C82,C85	T10uF
5	20	C10,C13,C17,C25,C28,C49, C61,C90,C92,C93,C94,C95, C96,C103,C104,C105,C106, C107,C108,C111	1nF
6	1	C11	47nF
7	12	C14,C15,C30,C51,C53,C77,C79, C80,C98,C100,C101,C102	10nF

8	2	C154,C22	4.7nF
9	1	C23	510pF
10	2	C26,C152	22nF
11	1	C31	3.3nF
12	1	C46	820pF
13	1	C60	15nF
14	3	C69,C147,C148	220nF
15	2	C73,C74	22pF
16	1	C89	1uF
17	2	C128,C132	100uF
18	1	C130	T1uF
19	3	C131,C138,C145	470uF
20	1	C136	1000uF
21	1	C137	22uF
22	1	C139	2.2uF
23	1	C143	470nF
24	1	C153	33nF
25	7	D1,D2,D3,D4,D5,D6,D7	1N4148
26	2	D8,D9	1N5158
27	2	G2,G3	Test Point
28	5	H1,H2,H3,H4,H5	MH
29	1	J1	HEADER 7 X 2
30	2	J2,J3	LMB0509-6P
31	1	J4	5267-3
32	1	J5	8283-14
33	1	J6	HIF3F-26PA-2.54DSA
34	1	J7	5267-6
35	1	J8	5267-4
36	2	J9,J12	5267-2
37	1	J10	HTJ-020-04
38	1	J11	HTJ-035-10
39	2	L1,L2	27uH
40	3	L3,L4,L5	220uH

41	1	P1	D-SUB 9 pin
42	1	Q1	MMBT3906
43	6	Q2,Q3,Q4,Q5,Q6,Q7	MMBT3904
44	5	Q8,Q9,Q10,Q11,Q12	DTA123
45	11	R1,R2,R8,R14,R17,R20,R23,R37 ,R86,R139,R153	1K
46	9	R3,R111,R112,R113,R114,R115, R116,R117,R119	100
47	14	R4,R5,R11,R18,R19,R24,R25, R32,R33,R45,R61,R68,R79,R142	20K
48	30	R6,R7,R10,R12,R13,R15,R28,R29, R30,R31,R34,R42,R43,R44,R46,R47 ,R55,R57,R62,R67,R70,R71,R72, R74,R76,R77,R78,R88,R90,R141	10K
49	3	R9,R16,R54	2M
50	1	R21	15K
51	1	R22	470
52	3	R26,R50,R69	68K
53	2	R27,R89	51K
54	9	R35,R65,R91,R92,R98,R129,R130, R131,R132	100K
55	6	R36,R49,R51,R87,R135,R136	20
56	7	R38,R48,R56,R64,R96,R97,R99	200K
57	1	R39	33K
58	6	R40,R58,R63,R75,R150,R151	2K
59	2	R41,R73	6.8K
60	5	R52,R66,R83,R85,R152	3.3K
61	2	R53,R143	150K
62	1	R59	10K 1%
63	1	R60	430K
64	1	R80	20K
65	1	R81	150K 1%
66	2	R82,R84	30K 1%

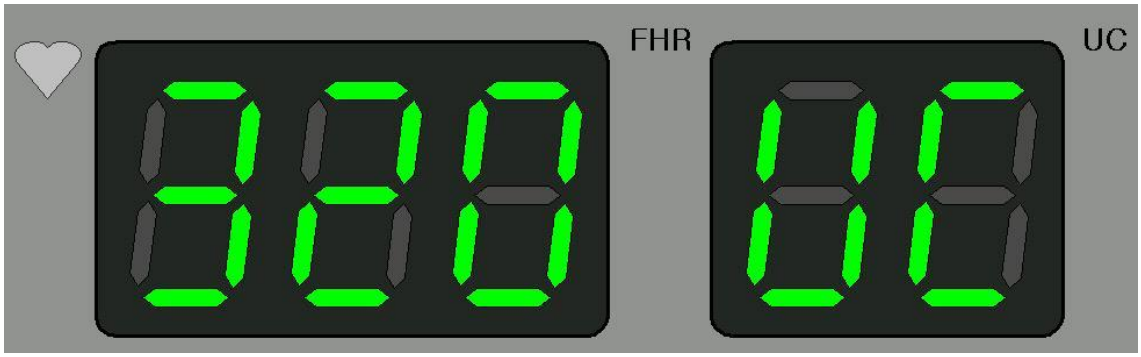
67	14	R93,R95,R107,R118,R120,R121, R122,R123,R124,R125,R126, R127,R128,R133	4.7K
68	1	R94	75K
69	5	R100,R101,R102,R103,R104	10
70	5	R105,R106,R108,R109,R110	330
71	1	R134	1
72	1	R137	33K 1%
73	1	R138	2K 1%
74	1	R140	220
75	2	R144,R145	120K
76	1	R146	56K
77	1	R147	270K
78	1	R148	560K
79	1	R149	180K
80	4	R154,R155,R156,R157	680
81	1	U1	DG212
82	2	U2,U5	74HC08
83	2	U3,U4	74HC393
84	2	U6,U20	74HC04
85	1	U7	SST39VF040(PLCC)
86	5	U8,U9,U14,U15,U33	TL064
87	1	U10	CD4051B
88	1	U11	K4S641632D
89	1	U12	S3C44B0X
90	1	U13	OSC 16MHz(3.3V)
91	1	U16	LM1117MPX-2.5
92	1	U17	LM78L05
93	1	U18	LM1117MPX-3.3

94	2	U19,U29	LM7812
95	1	U21	MM1075
96	5	U22,U23,U24,U25,U26	74HC245
97	1	U27	MAX232CSE
98	1	U28	ULN2064
99	1	U30	TDA2030
100	1	U31	LM2576S-5.0
101	1	U32	PQ2CF1
102	1	X1	32.768KHz

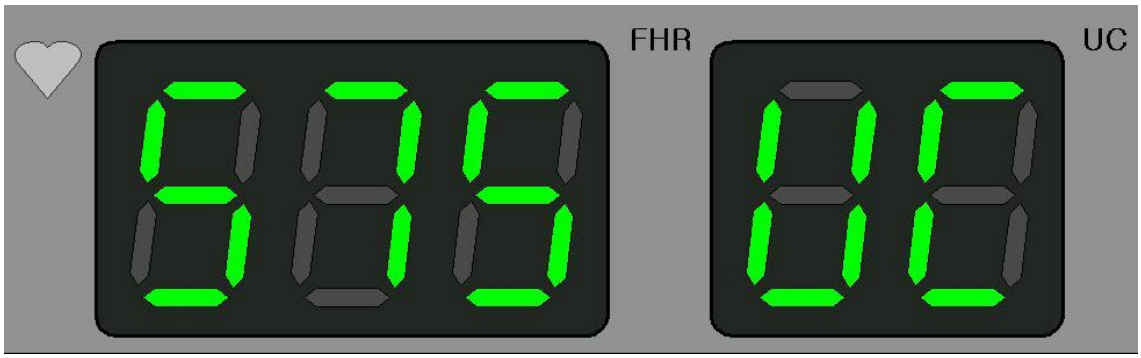
6. Calibration

1) UC calibration

1. Turn on the power with pushing the Reference key. At this time, the display of FHR shows the value of UC and the display of UC shows UC.
2. Open the upper cover of UC probe.
3. Turn the variable resistance toward the counterclockwise until the value of UC shows around 300.

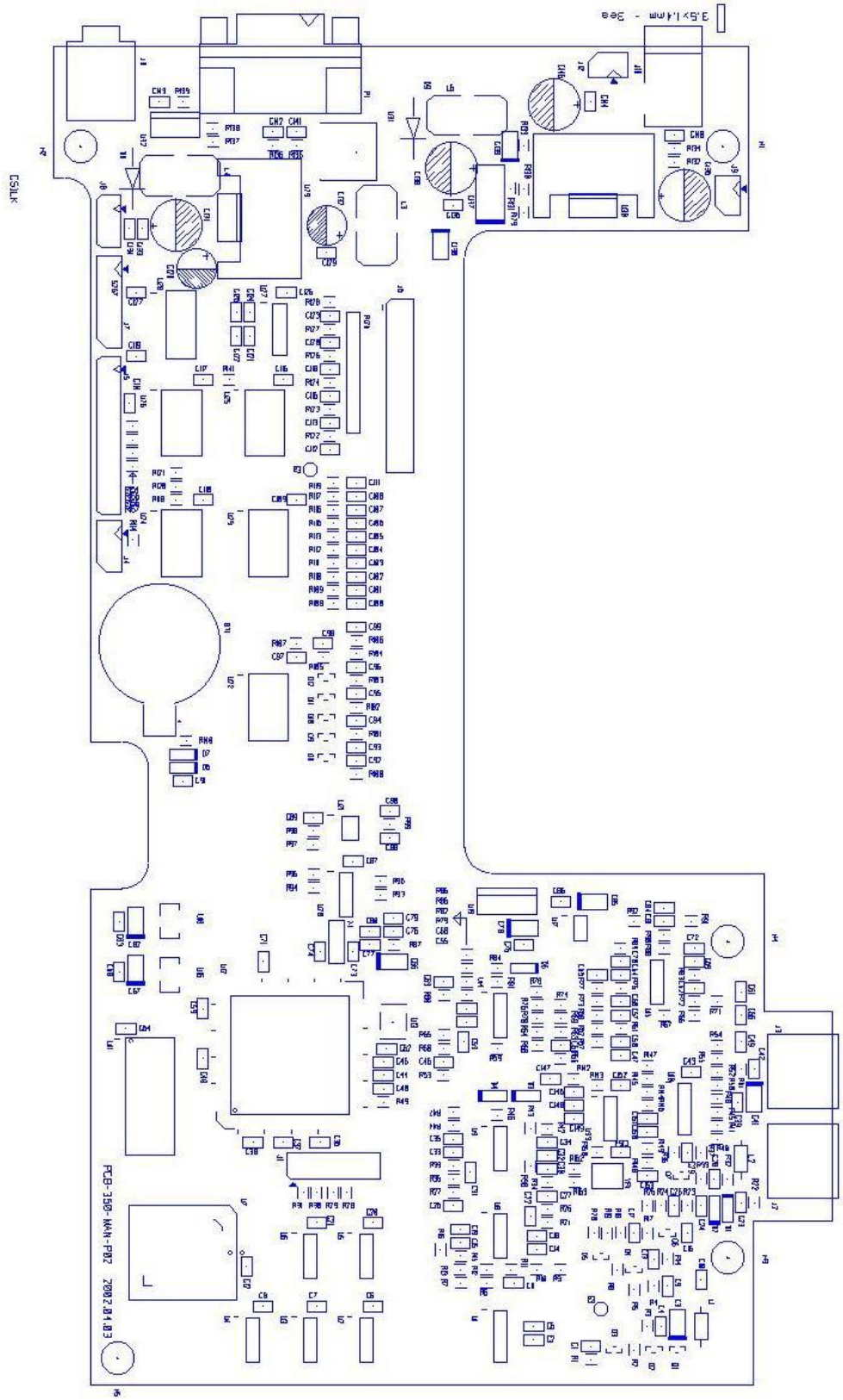


4. Turn the variable resistance toward the clockwise until the value of UC shows 550 ~ 600.

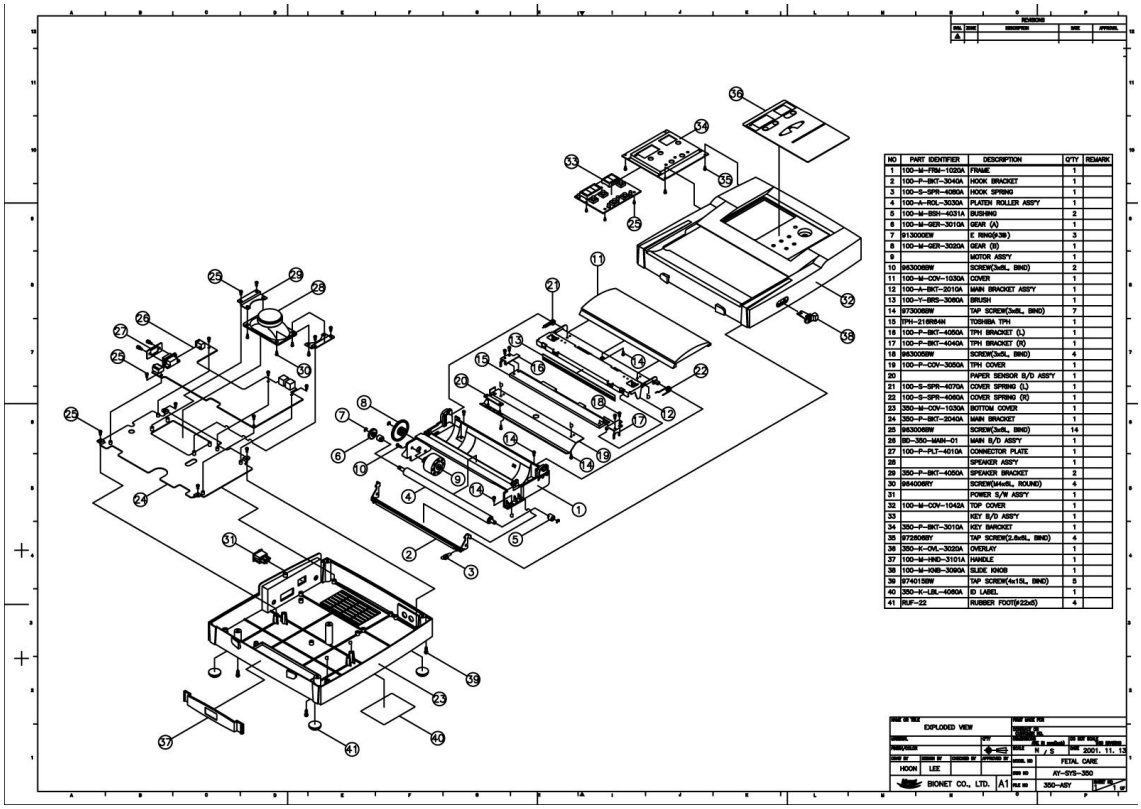


5. Close the upper cover of UC probe.

7. PCB Board Diagram



8. Assembly Drawings



NO	PART IDENTIFIER	DESCRIPTION	QTY	REMARK
1	100-M-FRM-1032A	FRAME	1	
2	100-P-BKT-3040A	HOOK BRACKET	1	
3	100-S-SPR-4080A	HOOK SPRING	1	
4	100-A-ROL-3030A	PLATEN ROLLER ASSY	1	
5	100-M-BSH-4031A	BUSHING	2	
6	100-M-GER-3010A	GEAR (A)	1	
7	913000EW	E RING(P3R)	3	
8	100-M-GER-3020A	GEAR (B)	1	
9		MOTOR ASSY	1	
10	963006BW	SCREW(3x8L, BIND)	2	
11	100-M-COV-1030A	COVER	1	
12	100-A-BKT-3010A	MAIN BRACKET ASSY	1	
13	100-Y-BRS-3060A	BRUSH	1	
14	973008BW	TAP SCREW(3x8L, BIND)	7	
15	TPH-216R64N	TOSHIBA TPH	1	
16	100-P-BKT-4060A	TPH BRACKET (L)	1	
17	100-P-BKT-4040A	TPH BRACKET (R)	1	
18	963006BW	SCREW(3x8L, BIND)	4	
19	100-P-COV-3050A	TPH COVER	1	
20		PAPER SENSOR B/D ASSY	1	
21	100-S-SPR-4070A	COVER SPRING (L)	1	
22	100-S-SPR-4060A	COVER SPRING (R)	1	
23	350-M-COV-1030A	BOTTOM COVER	1	
24	350-P-BKT-2040A	MAIN BRACKET	1	
25	963006BW	SCREW(3x8L, BIND)	14	
26	SD-350-MAN-01	MAIN B/D ASSY	1	
27	100-P-PLT-4010A	CONNECTOR PLATE	1	
28		SPEAKER ASSY	1	
29	350-P-BKT-4050A	SPEAKER BRACKET	2	
30	964008RY	SCREW(M4x8L, ROUND)	4	
31		POWER S/N ASSY	1	
32	100-M-COV-1042A	TOP COVER	1	
33		KEY B/D ASSY	1	
34	350-P-BKT-3010A	KEY BARCKET	1	
35	973808BY	TAP SCREW(2.6x8L, BIND)	4	
36	350-K-OVL-3020A	OVERLAY	1	
37	100-M-HND-3101A	HANDLE	1	
38	100-M-KNB-3090A	SLIDE KNOB	1	
39	974015BW	TAP SCREW(4x15L, BIND)	5	
40	350-K-LBL-4080A	ID LABEL	1	
41	RUF-22	RUBBER FOOT(P22x5)	4	

EXPLODED VIEW

HOON LEE

BIONET CO., LTD. A1

AY-SYS-350

350-ASY